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The writer has during the past few years propagated several thousand apple trees of many different varieties on their own roots by means of the common whip graft, but cutting off the seedling nurse root after two seasons' growth and replanting those trees which had thrown out roots from the scion, thus establishing the variety on its own roots. Many of these trees have been more or less troubled with the crown gall and hairy root. It has been observed that there is a tendency for a given variety to have only a single form of the disease. Thus the Jewett apple shows usually if not always the hard form of the gall, the Red Astrachan the simple form of the hairy root and the Oldenburg the woolly knot form with many soft fleshy root growths. Other varieties show the broom root form and still others often the aerial form.

In the ordinary method of propagation of apple trees the root systems are of seedling origin and from a pomological viewpoint the root system of every tree is a different variety. May not this be the reason for the various forms of crown gall and hairy root?

Some varieties on their own roots seem to be largely if not entirely immune to this disease. If this proves to be really the case, here may lie the solution of the problem of the prevention of crown gall. If a resistant variety is selected as the root variety, and the variety desired propagated on it, trees immune to the disease may presumably be secured. Probably the economic advantage would warrant the extra effort necessary to propagate such trees, only under conditions where the crown gall was especially troublesome.

There are other root diseases which are injurious, especially through the southern part of the apple belt, that might possibly be avoided in a similar fashion.

J. K. SHAW

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WHEN A FORCE IS A FORCE

REFERRING to the perennial discussion of the meaning of force and of the law of action and reaction, lately revived in the pages of SCIENCE,¹

I venture to suggest that the essential point of the alleged difficulties which have been raised is covered by the following simple propositions:

1. A force is a *push* or a *pull* exerted upon a body (portion of matter) by another body.
2. Whenever a body *A* pushes or pulls a body *B*, then at the same time *B* pushes or pulls *A* equally in the opposite direction. Such a pair of forces is an "action and reaction." *An action-reaction pair concerns two bodies and only two.*
3. The two forces of an action-reaction pair never balance each other; a force acting on *A* can not balance a force acting on *B*.
4. To balance a force acting on *B*, another force must be applied to *B*.

One who keeps these simple facts in mind will, I believe, find it easy to decide whether an alleged force is really a force in the meaning of the Newtonian laws. He will also see that there is no contradiction between the statement that forces always occur in action-reaction pairs and the statement that forces are often unbalanced.

L. M. HOSKINS

STANFORD UNIVERSITY,
March 22, 1917

SCIENTIFIC BOOKS

The Potato. By ARTHUR W. GILBERT, assisted by MORTIER F. BARRUS and DANIEL DEAN. New York, The Macmillan Co., 1917. Pp. i-xii and 1-318, Pl. XVI.

The author states in his preface that the book is intended to give brief and practical suggestions on the growing, breeding and marketing of potatoes, and the subject-matter amply substantiates the statement. This publication, in addition to being up-to-date in its cultural directions, devotes considerably more attention to the subject of potato breeding than any of our preceding American treatises on the potato. Conveniently arranged statistical data are presented in Chapter I. under the caption of Acreage, Distribution, Production and Valuation. Chapter III. em-

¹ See articles by Gordon S. Fulcher (November 24, 1916), and Andrew H. Patterson (March 16, 1917). Mr. Fulcher's discussion seems to me to be entirely sound.